Fundamental way of pursuing extreme values

Prerequisites / Entry Requirements

- *Good completion on Grade 5 of K12 system in the United States*
- Master Meta Forge Level 1 Logic Pattern all Sessions

Standard Problem-Solving Pathway

Start by constructing a solution from the theoretical extreme value; if unsuccessful, strictly reverse the order step by step.

Example 1 *There are 10 decimal numbers: 0.3, 0.33, ..., up to a number with nine 3's after the decimal point (0.333333333). What is the smallest number of these values that must be selected so that their sum is greater than 2?.*

Example 2 *Seven plates are arranged in a row, numbered 1 through 7. Each plate contains some glass beads, totaling 80 beads in all. Plate 1 contains 18 beads, and the sum of the beads in any three consecutively numbered plates is the same. What is the maximum possible number of beads that could be in the sixth plate?*

Example 3 *A multi-digit number has all distinct digits, and the sum of its digits is 23. What is the smallest possible such number? What is the largest possible such number?*

Example 4 *A certain country has five denominations of currency: 1 unit, 3 unit, 5 unit, 7 unit, and 9 unit. What is the minimum number of bills needed to be able to pay any integer amount from 1 unit to 100 unit?*

Example 5 *A bag contains:10 red balls labeled 6; 10 yellow balls labeled 7,10 green balls labeled 8.Alice draws some balls and sums the numbers written on them. The total is 59.*

What is the maximum possible number of red balls he could have drawn?.

Example 6 *On the blackboard are written the numbers 1, 2, 3, 4, ..., 2026, each exactly once. Each time, Bob erases two numbers of the same parity (both even or both odd), and writes down their average. In the end, only one natural number remains. What is the maximum possible value of that number?.*

Example 7 *A king awards 10 bags of gold coins to three ministers, A, B, and C. The bags contain 1, 2, ..., 10 gold coins respectively. Minister A discovers that, without opening the bags, he can divide his coins into two equal piles. Minister B discovers that he can divide his coins into two piles such that one pile has twice as many coins as the other. Minister C discovers that he can divide his coins into two piles such that one pile has three times as many coins as the other. What is the minimum number of gold coins Minister A could have received?.*

Example 8 *The first 99 natural numbers are written in order from smallest to largest: 1234567891011121 3……9899. Insert one plus sign (+) somewhere in this sequence to form an addition expression, such that the result is as small as possible. What are the last four digits of this result?*

Example 9 *For a two-digit number divided by the sum of its digits, what is the maximum possible remainder?*

Example 10 *Seven distinct non-negative integers (including 0) sum to 100. What is the maximum possible value of the largest number? What is the maximum possible value of the smallest number? What is the minimum possible value of the largest number?*

Summary:

In various mathematical scenarios, standard problem-solving approaches for extreme value problems are applied to solidify fundamental concepts.

- Arithmetic sequence
- Period Issue
- Resource allocation principle
- Single operation principle
- Place Value
- Reminder.

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Homework:

- beyond this video.
- The answers and hints for the exercises IN the exercises file